

What is claimed is:

1. A voltage regulator of a vehicle AC generator including a field coil and a rectifier for rectifying generated AC output, said voltage regulator comprising:

a semiconductor element connected to said field coil for controlling current supplied to said field coil;

a flywheel element connected in parallel with said field coil;

generation voltage regulating means for controlling said semiconductor element to turn on or off so that an output voltage of said rectifier can be regulated to a regulated voltage according to a signal related to said output voltage; and

switching capacity control means for controlling a current-switching capacity during a former stage of a turn-off transition period of said semiconductor element to be larger than that during the latter stage of the turn-off transition period.

2. The voltage regulator of a vehicle AC generator according to claim 1, wherein

said switching capacity control means changes one of control voltage and control current of said semiconductor element at an approximately fixed change rate during said former stage of said turn-off transition period and said the latter stage, and

said change rate at the former stage is set larger than the change rate at the latter stage.

3. The voltage regulator of a vehicle AC generator according to claim 2, wherein

 said semiconductor element carries out follower operation.

4. The voltage regulator of a vehicle AC generator according to claim 1, further comprising:

 a comparator for comparing a signal voltage related to a voltage drop of main electrodes of said semiconductor element with a reference value; and

 said switching capacity control means decreases a decrease rate of current switching capacity of the control electrode of said semiconductor element to a smaller value right after said signal voltage becomes said reference value during said turn-off transition period.

5. The voltage regulator of a vehicle AC generator according to claim 4, wherein

 said comparator increases charging current of said gate electrode of said semiconductor element, right after said signal voltage becomes said reference value during the turn-on transition period of said semiconductor element; and

 said reference value for changing said charging current during said turn-on transition period is set lower than a

predetermined value for changing said charging current during said turn-off transition period.

6. A voltage regulator of a vehicle AC generator including a field coil and a rectifier for rectifying generated AC output, said voltage regulator comprising:

a semiconductor element for controlling current supplied to said field coil;

a flywheel element connected in parallel with said field coil;

generation voltage regulating means for controlling said semiconductor element to turn on or off so that an output voltage of said rectifier can be regulated to a predetermined control voltage according to a signal that is related to said output voltage; and

switching capacity control means for controlling said semiconductor element; wherein said drive means comprises:

a charge pump voltage boosting circuit that supplies said semiconductor element in follower operation with a higher gate voltage than output voltage; and

an operation control circuit for stopping said charge pump circuit from a former stage of turn-off transition period of said semiconductor element.

7. A voltage regulator of a vehicle AC generator including a field coil and a rectifier for rectifying generated AC output comprising:

a semiconductor element for controlling current supplied to said field coil;

a flywheel element connected in parallel with said field coil;

generation voltage regulating means for controlling said semiconductor element to turn on or off so that an output voltage of said rectifier can be regulated to a predetermined control voltage according to a signal that is related to said output voltage; and

switching capacity control means for controlling said semiconductor element; wherein said switching capacity control means comprises:

a diode formed of a diode of a short recovery time; the maximum current change rate (%) of said semiconductor element during said recovery period is less than twice as long as the maximum current change rate (%) during turn-off transition period or turn-on transition period of said semiconductor element.

8. A voltage regulator of a vehicle AC generator including a field coil and a rectifier for rectifying generated AC output to charge a battery, said voltage regulator comprising:

a switching element having main current switching terminals and a control gate for controlling current supplied to said field coil;

a flywheel element connected in parallel with said field

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coil;

a battery condition check circuit;

a terminal voltage check circuit for detecting terminal voltage across said main terminals of said switching element;

a gate charge circuit, connected to said terminal voltage check circuit, for supplying gate current to said gate;

a gate discharge circuit, connected to said terminal voltage check circuit, for discharging current from said gate;
wherein

said gate charge circuit increases said gate current quickly when said terminal voltage starts decreasing; and

said gate discharge circuit increases current discharging from said gate quickly when said terminal voltage starts increasing and thereafter increases gradually.

9. The voltage regulator of a vehicle AC generator according to claim 8, wherein

said gate charge circuit comprises a mirror circuit connected to said control gate.

10. The voltage regulator of a vehicle AC generator according to claim 8, wherein

said gate discharge circuit comprises a transistor having an control electrode and connected to said gate and a mirror circuit connected to said control electrode of said transistor.